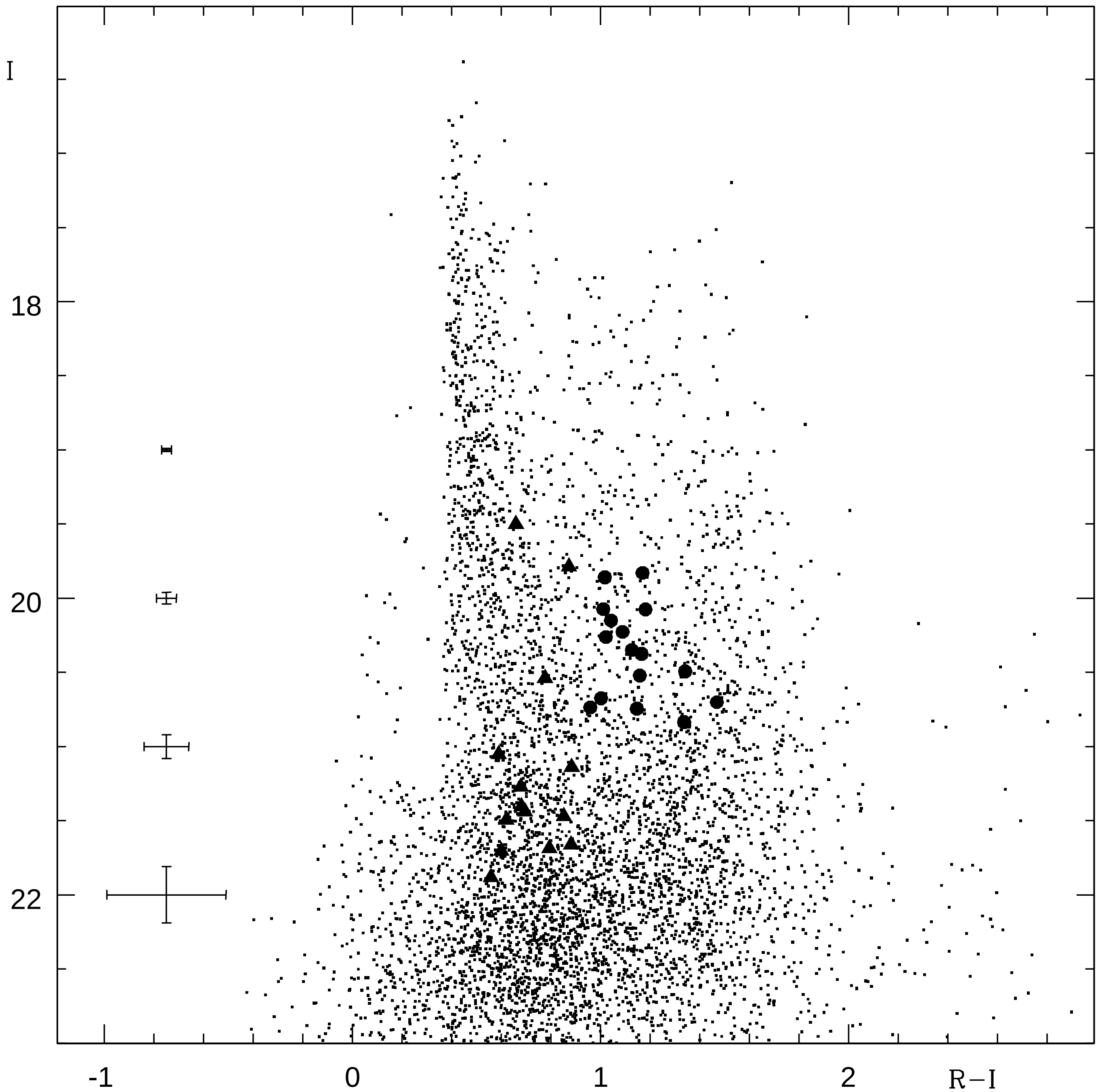
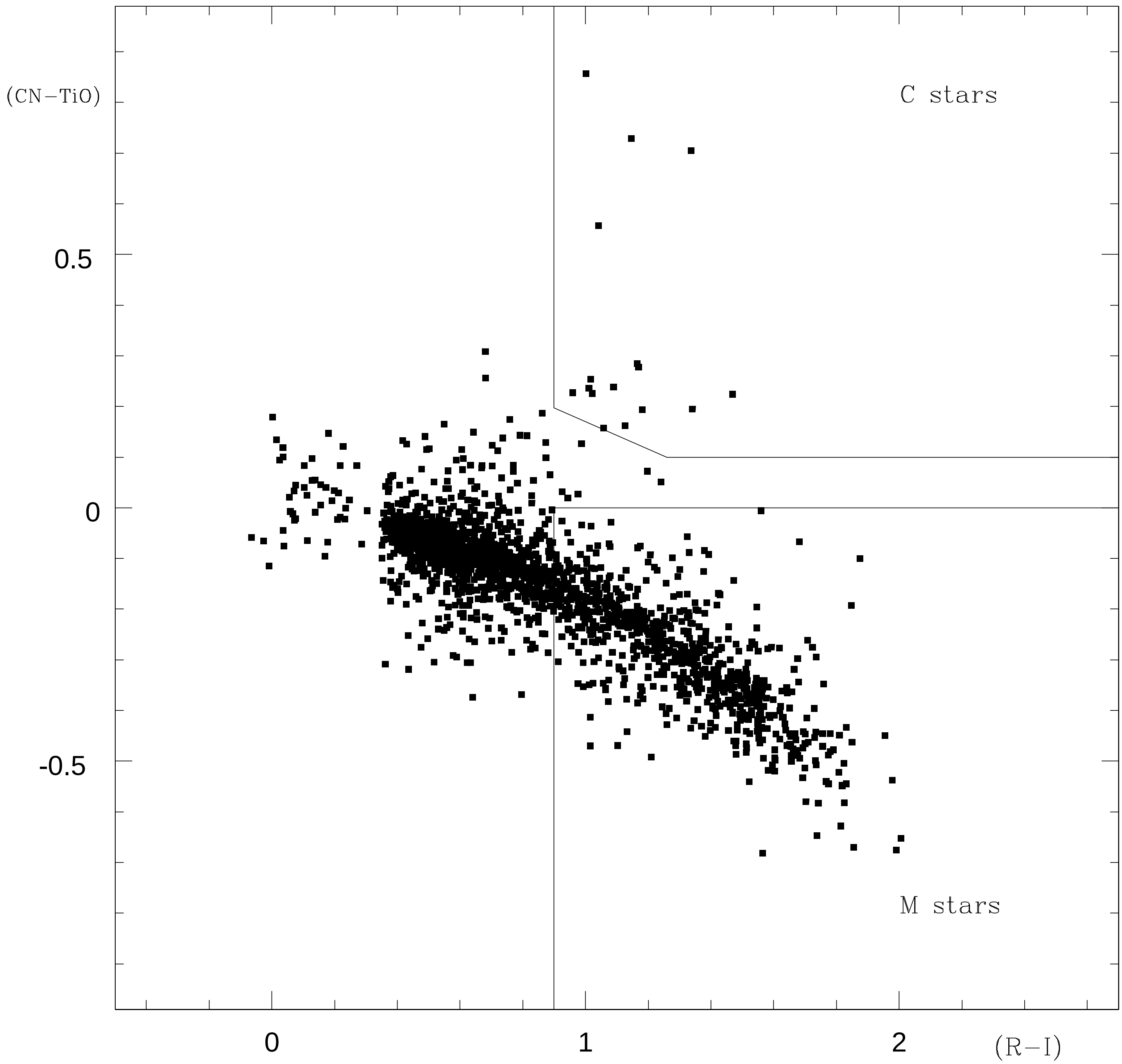

I
18
20
22
-1
0
1
2
R−I

Table 1. Adopted properties of SagDIG and Leo I

| | SagDIG | Leo I |
|---|---|---|
| E(B–V) | 0.05 | 0.02 |
| E(R–I) | 0.04 | 0.016 |
| $A_I$ | 0.12 | 0.04 |
| $(M–m)_\circ$ | 25.30±0.14 | 22.18±0.11 |
| [Fe/H] | –2.4 | –2.0 |
| $M_V^T$ | –11.85±0.20 | –11.9±0.3 |



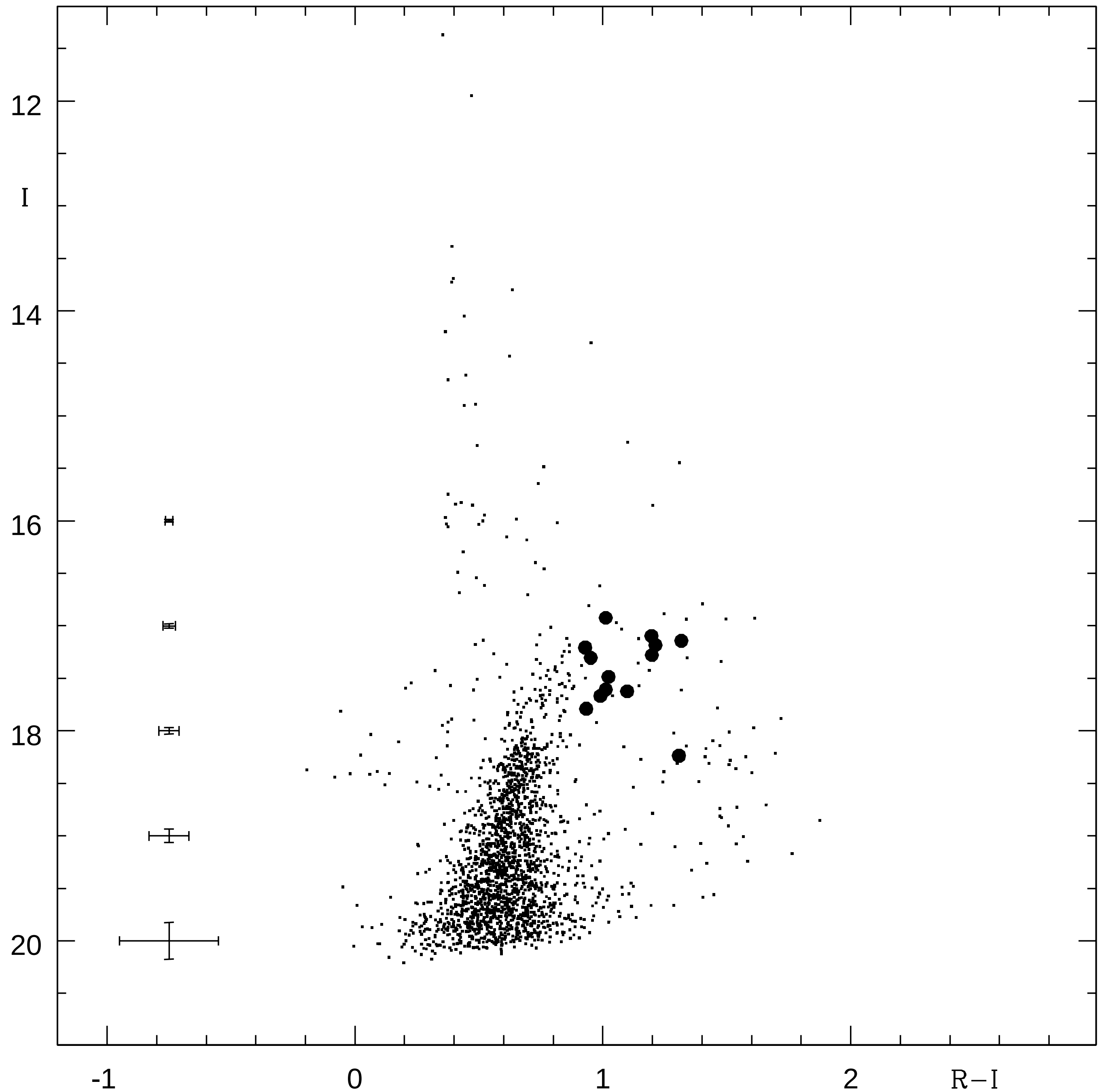
(CN−TiO)
0.5
0
-0.5
C stars
M stars
0
1
2
(R−I)

Table 2. Journal of observations

| Dates | filter | Time (s) | FWHM (arcsec) | Air Mass |
|---|---|---|---|---|
| SagDIG: | | | | |
| 1999 Aug 9........ | R | 1200 | 1.2 | 1.097 |
| 1999 Aug 10...... | I | 1200 | 1.2 | 1.354 |
| 1999 Aug 10...... | R | 1200 | 1.2 | 1.130 |
| 1999 Aug 10...... | TiO | 2×1200 | 1.2 | 1.160 |
| 1999 Aug 10...... | CN | 1200 | 1.1 | 1.186 |
| 1999 Aug 11...... | I | 2×1200 | 1.5 | 1.227 |
| 1999 Aug 11...... | R | 2×1200 | 1.6 | 1.163 |
| 1999 Aug 11...... | TiO | 5×1200 | 1.4 | 1.103 |
| 1999 Aug 11...... | CN | 6×1200 | 1.3 | 1.085 |
| 1999 Aug 12...... | R | 1200 | 1.2 | 1.397 |
| 1999 Aug 12...... | TiO | 2×1200 | 1.1 | 1.226 |
| 1999 Aug 12...... | CN | 2×1200 | 1.2 | 1.166 |
| 1999 Aug 13...... | I | 1200 | 0.9 | 1.474 |
| 1999 Aug 13...... | TiO | 1200 | 1.2 | 1.353 |
| 1999 Aug 13...... | CN | 1200 | 1.1 | 1.259 |
| Leo I comp: | | | | |
| 2001 Apr 15...... | I | 60 | 1.5 | 1.549 |
| 2001 Apr 15...... | R | 72 | 1.7 | 1.534 |

Table 2—Continued

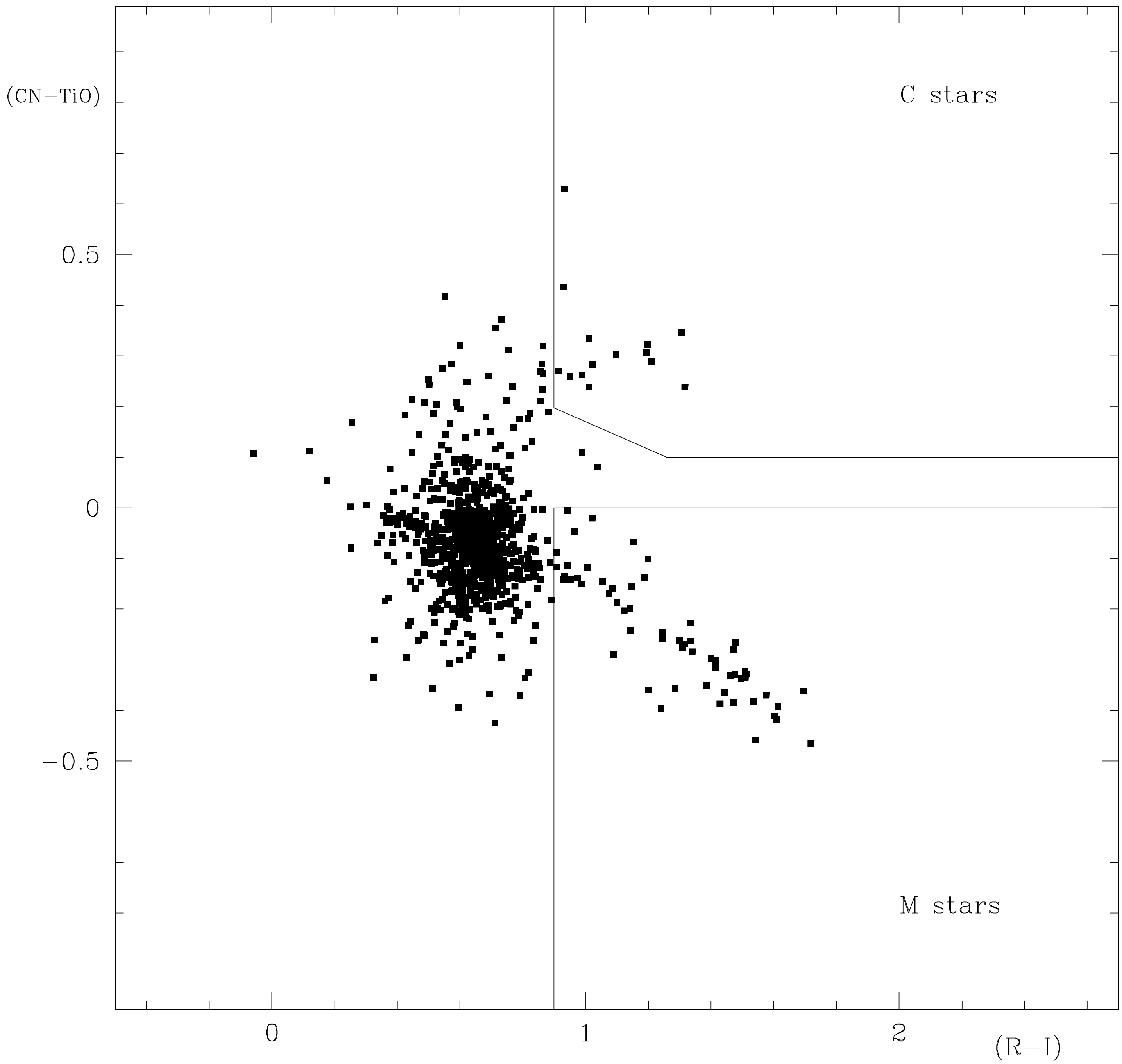
| Dates | filter | Time (s) | FWHM (arcsec) | Air Mass |
|---|---|---|---|---|
| 2001 Apr 15...... | CN | 240 | 1.5 | 1.519 |
| 2001 Apr 15...... | TiO | 240 | 1.5 | 1.496 |
| Leo I: | | | | |
| 2001 Apr 15...... | I | 60 | 1.421 | 1.6 |
| 2001 Apr 15...... | R | 72 | 1.428 | 1.4 |
| 2001 Apr 15...... | CN | 240 | 1.405 | 1.4 |
| 2001 Apr 15...... | TiO | 240 | 1.395 | 1.3 |



12
14
16
18
20
I
-1
0
1
2
R−I

Table 3. C stars in the Sagittarius dwarf galaxy

| id | RA | Dec | I | $\sigma_I$ | R–I | $\sigma_{R-I}$ | CN–TiO | $\sigma_{CN-TiO}$ |
|---|---|---|---|---|---|---|---|---|
| C01 | 19:30:01.02 | –17:40:52.6 | 19.859 | 0.014 | 1.017 | 0.022 | 0.254 | 0.023 |
| C02 | 19:30:08.16 | –17:40:00.8 | 19.830 | 0.015 | 1.169 | 0.023 | 0.278 | 0.025 |
| C03 | 19:30:02.02 | –17:42:05.7 | 20.076 | 0.018 | 1.181 | 0.030 | 0.194 | 0.029 |
| C04 | 19:30:00.07 | –17:41:35.2 | 20.074 | 0.017 | 1.011 | 0.027 | 0.236 | 0.030 |
| C05 | 19:30:06.27 | –17:40:54.6 | 20.150 | 0.019 | 1.042 | 0.028 | 0.557 | 0.033 |
| C06 | 19:29:52.89 | –17:40:32.7 | 20.227 | 0.020 | 1.089 | 0.031 | 0.238 | 0.032 |
| C07 | 19:29:55.23 | –17:40:22.6 | 20.262 | 0.020 | 1.021 | 0.030 | 0.226 | 0.033 |
| C08 | 19:30:04.19 | –17:40:30.2 | 20.375 | 0.022 | 1.165 | 0.036 | 0.285 | 0.039 |
| C09 | 19:30:05.19 | –17:41:42.8 | 20.349 | 0.027 | 1.126 | 0.042 | 0.162 | 0.038 |
| C10 | 19:30:01.68 | –17:41:06.6 | 20.493 | 0.026 | 1.341 | 0.049 | 0.195 | 0.042 |
| C11 | 19:29:56.33 | –17:40:47.3 | 20.674 | 0.031 | 1.002 | 0.048 | 0.857 | 0.064 |
| C12 | 19:29:50.49 | –17:39:10.2 | 20.521 | 0.035 | 1.158 | 0.065 | 0.557 | 0.119 |
| C13 | 19:29:57.55 | –17:40:41.8 | 20.735 | 0.031 | 0.959 | 0.046 | 0.227 | 0.047 |
| C14 | 19:29:52.89 | –17:41:39.5 | 20.745 | 0.031 | 1.146 | 0.052 | 0.729 | 0.061 |
| C15 | 19:30:00.29 | –17:41:02.8 | 20.701 | 0.032 | 1.469 | 0.061 | 0.224 | 0.053 |
| C16 | 19:30:00.24 | –17:40:54.4 | 20.835 | 0.035 | 1.337 | 0.072 | 0.705 | 0.073 |

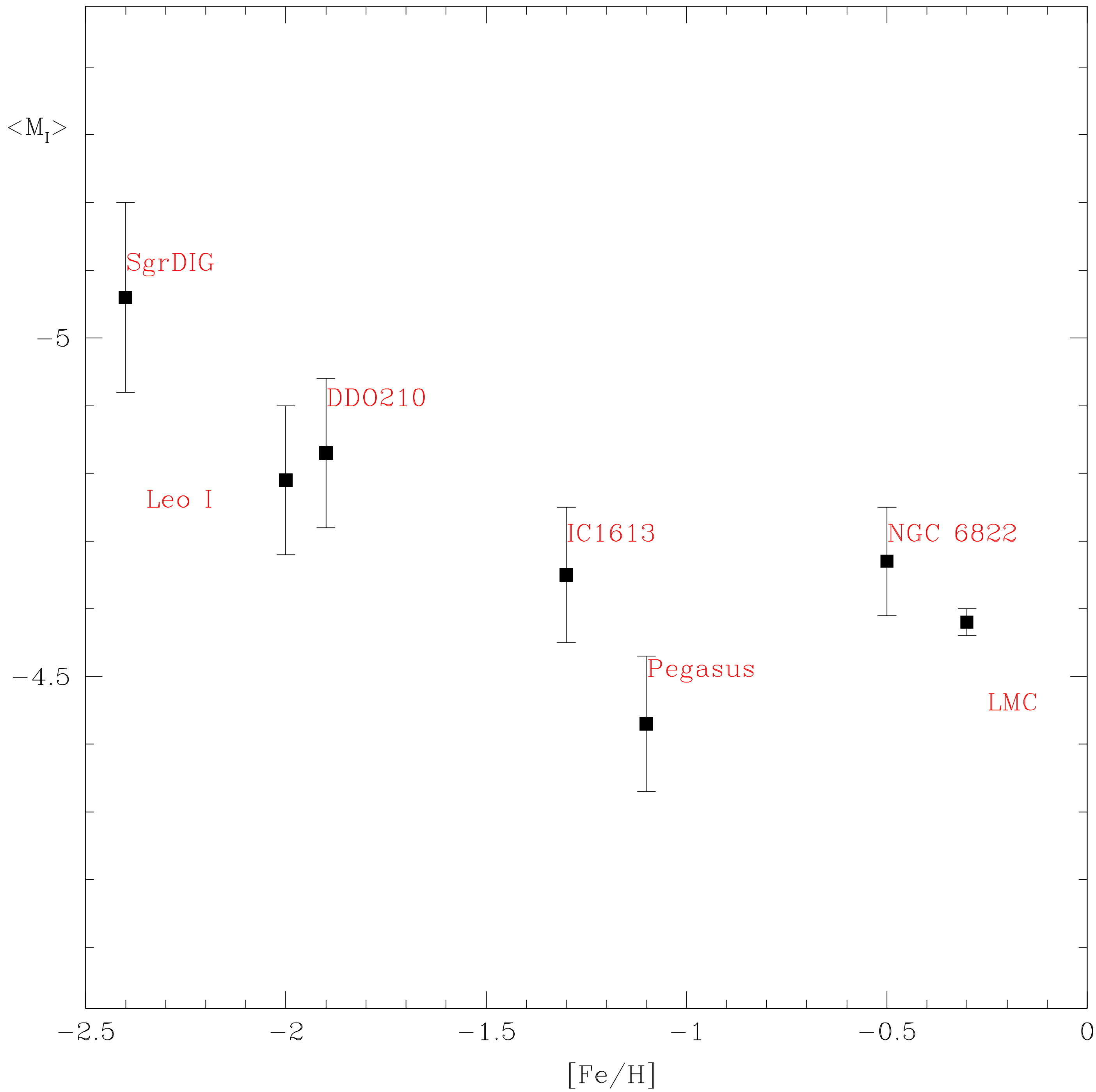


(CN−TiO)
C stars
M stars
0.5
0
−0.5
0
1
2
(R−I)

Table 4. C stars in Leo I

| id | RA | Dec | I | $\sigma_I$ | R–I | $\sigma_{R-I}$ | CN–TiO | $\sigma_{CN-TiO}$ | note |
|---|---|---|---|---|---|---|---|---|---|
| C01 | 10:08:19.97 | 12:17:42.1 | 16.923 | 0.084 | 1.012 | 0.086 | 0.238 | 0.027 | |
| C02 | 10:08:20.09 | 12:20:03.1 | 17.097 | 0.016 | 1.196 | 0.025 | 0.307 | 0.025 | 1 |
| C03 | 10:08:20.66 | 12:18:37.2 | 17.142 | 0.017 | 1.317 | 0.029 | 0.238 | 0.025 | 1 |
| C04 | 10:08:11.71 | 12:18:34.3 | 17.183 | 0.016 | 1.212 | 0.028 | 0.290 | 0.025 | 1 |
| C05 | 10:08:22.56 | 12:18:26.5 | 17.207 | 0.018 | 0.929 | 0.025 | 0.436 | 0.026 | |
| C06 | 10:08:25.30 | 12:18:30.8 | 17.304 | 0.020 | 0.951 | 0.030 | 0.259 | 0.033 | |
| C07 | 10:08:32.36 | 12:18:46.7 | 17.279 | 0.020 | 1.198 | 0.031 | 0.322 | 0.030 | 1 |
| C08 | 10:08:39.92 | 12:22:15.1 | 17.485 | 0.024 | 1.023 | 0.033 | 0.283 | 0.032 | 1 |
| C09 | 10:08:21.76 | 12:17:25.6 | 17.607 | 0.024 | 1.012 | 0.034 | 0.334 | 0.034 | |
| C10 | 10:08:25.63 | 12:18:57.7 | 17.624 | 0.026 | 1.098 | 0.036 | 0.302 | 0.033 | |
| C11 | 10:08:12.89 | 12:19:38.7 | 17.668 | 0.025 | 0.990 | 0.035 | 0.262 | 0.036 | 1 |
| C12 | 10:08:28.51 | 12:19:49.2 | 17.790 | 0.029 | 0.933 | 0.039 | 0.629 | 0.039 | |
| C13 | 10:08:22.69 | 12:23:16.6 | 18.237 | 0.035 | 1.307 | 0.057 | 0.346 | 0.054 | 1 |

[1]Newly identified C stars



$<M_I>$
−5
−4.5
SgrDIG
DDO210
Leo I
IC1613
NGC 6822
Pegasus
LMC
−2.5
−2
−1.5
−1
−0.5
0
[Fe/H]

# C Star survey of Local Group Dwarf Galaxies. III
# The Sagittarius dwarf irregular and the Leo I dwarf spheroidal galaxies

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Received ____________; accepted ____________

submitted to AJ

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## ABSTRACT

We present the latest results of our ongoing homogeneous cool C star survey of Local Group dwarf galaxies. We apply our two color photometric technique to the study of two small galaxies: the Sagittarius dwarf (SagDIG) and Leo I. We identify 16 C stars in SagDIG and 13 C stars in Leo I. Even though both galaxies have a known C star population, we identify 7 previously unknown C stars in each galaxy. The photometric properties of all the known C stars in each galaxy are presented. It is shown that our definition of a C star, based on our photometric criteria, produces a subset of carbon stars with homogeneous properties useful for population comparison.

*Subject headings:* galaxies: individual (SagDIG, Leo I) — galaxies: stellar content — stars: carbon

## 1. INTRODUCTION

To pursue our ongoing programme (Albert et al. 2000; [Paper I] and Battinelli & Demers 2000, [Paper II]) to determine and compare the photometric properties of cool C stars in dwarf galaxies, we present the results of a survey of the Sagittarius dwarf galaxy (SagDIG) and of Leo I, a satellite of the Milky Way. This is done to establish if their mean $M_I$ can be used as a standard candle and if their mean colors and/or magnitudes are function of the metallicity or other properties of the parent galaxy.

SagDIG was discovered independently, on ESO and SERC survey plates, by Cesarsky et al. (1977) and Longmore et al. (1978). SagDIG is located in the direction toward the Galactic center ($\ell = 21°$) at $\alpha_{2000} = 19^h29^m59^s$, $\delta_{2000} = -17°40'41''$, thus it is at a relatively low Galactic latitude, $b = -16.3°$. This dwarf galaxy, located on the outskirts of the Local

Group (van den Bergh 2000), has recently been the subject of two independent photometric studies. Both investigations determined its distance from the apparent magnitude of the tip of its giant branch, (TRGB) their results are consistent with each other. Karachentsev, Aparicio & Makarova (1999) found a distance of 1.06 ±0.10 Mpc while Lee & Kim (2000) found 1.18 ± 0.10 Mpc. Because their adopted color excesses are different, we detail in 3.1.2 the reasons for our choice of E(R–I).

Leo I is one of the nine dwarf spheroidal galaxies (dSph) associated with the Milky Way. It was discovered, while inspecting Palomar Sky Survey plates, by Harrington & Wilson (1950); it has since that time been the subject of several investigations. Leo I is among the most massive dSph satellites of the Galaxy, it contains a substantial intermediate age population which until fairly recently was believed to represent also the oldest population of Leo I (Held et al. 2000). We adopt, for the distance and extinction of Leo I the values obtained by Lee et al. (1993) from the apparent magnitude of the tip of the giant branch.

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Table 1 summarizes the currently known and adopted properties of SagDIG and Leo I, $M_V^T$ is the integrated absolute magnitude.

C stars are known to exist in both galaxies. Cook (1987) surveyed SagDIG employing a four-filter technique similar to ours. Leo I was observed spectroscopically, using a grism technique, by Azzopardi, Lequeux & Westerlund (1985;1986) and by Aaronson, Olszewski & Hodge (1983) using near infrared photometry. Our observations of Leo I will be particularly interesting to link our photometry to a population of spectroscopically confirmed C stars. As we shall see, our technique permits only the identification of the coolest C stars,thus defining a subset with narrower range of properties.

## 2. OBSERVATIONS AND DATA REDUCTION

The observations presented in this paper were obtained at the CTIO 1.5 m telescope with a 2048×2048 Tek CCD during two runs: a five night run in August 1999 and a three night run in April 2001. For the first run, the telescope was employed at the f/13.5 focus, yielding a pixel size of 0.24″ and a field of view of $8.2' \times 8.2'$. This field is deemed suitable for the small galaxies under investigation. It further allows to evaluate the foreground contamination. For the second run, the f/7.5 focus, yielding a pixel size of 0.432″ and a field of view of $15' \times 15'$ was adopted. To photometrically identify C stars, we employed the technique used in Paper I and described by Brewer, Richer & Crabtree (1995), see also Cook, Aaronson & Norris (1986). Standard Kron-Cousins R and I filters are used along with CN and TiO interference filters respectively centered at 810 nm and 770 nm. Both filters have a width of 30 nm. The calibration and data reduction of both runs were done in the same way. The reader is referred to Paper II of this series which detailed the calibration and data reduction procedure. The journal of observation is presented in Table 2.

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Sky flats were obtained each night through each filters. Calibration to the standard R, I system was done using Landolt's (1992) equatorial standards observed during the course of the night. Extinction coefficients and transformation equations were obtained by multilinear regressions. Details are presented in Paper II.

After the standard prereduction of trimming, bias subtraction, and sky flat-fielding, the photometric reductions were done by fitting model point-spread functions (PSFs) using DAOPHOT/ALLSTAR/ALLFRAME series of programs (Stetson 1987, 1994) in the following way: we combine, using MONTAGE2, all the images of the target irrespective of the filter to produce a deep image devoid of cosmic rays. ALLSTAR was then used

on this deep image to derive a list of stellar images and produce a second image where the stars, found in the first pass, are removed. This subtracted image is also processed through ALLSTAR to find faint stars missed in the first pass. The second list of stars is added to the first one. The final list is then used for the analysis of the individual frames using ALLFRAME. This program fits model PSFs to stellar objects in all the frames simultaneously.

## 3. RESULTS

### 3.1. SagDIG

#### *3.1.1. The color-magnitude diagram*

Figure 1 displays the color-magnitude diagram for stars with DAOPHOT computed errors for $(R - I)$ less than 0.1 mag. It is based on exposures totaling 100 minutes in R and 80 minutes in I. A comparison of this figure with the CMD produced by Lee & Kim (2000) shows that the magnitude limit of our diagram is half a magnitude fainter than the red giant tip of SagDIG, which is difficult to see because of the numerous foreground stars, many of them redder than C stars.

EDITOR: PLACE FIGURE 1 HERE.

#### *3.1.2. Reddening and adopted distance*

One can estimate, approximately, the reddening toward SagDIG from the CMD displayed in Figure 1. The $(R - I)$ distribution of foreground stars, in the CMD, is quite sharply limited on the blue side. This limit, corresponding to the main sequence turnoff

of field G dwarfs, is seen at $(R-I)=0.39$. If we adopt $(R-I)_{\circ}\approx 0.35$ for G5 dwarfs (Cox 2000), then the E(R–I) $\approx$ 0.04, corresponding to color excess E(B–V) $\approx$ 0.05. This evaluation confirms the low reddening estimate by Lee & Kim (2000), made from a two-color diagram. We adopt a low reddening value. G dwarfs, along the line of sight, are distributed along the first kiloparsecs because, at a distance of 5 kpc the line of sight is already 1500 pc below the Galactic disc. The position of the blue ridge in the CMD of NGC 6822 (Letarte, Demers & Battinelli in preparation) is located at $(R-I)\approx 0.56$, a position expected from the published reddening of that galaxy. Cook (1987) used a similar technique to evaluate the reddening toward SagDIG. He also concluded that the reddening is low.

The adopted absolute magnitude of SagDIG is based on their respective evaluation of the integrated apparent magnitude of this galaxy and again, taking into account our adopted reddening.

#### *3.1.3. The color-color diagram*

Figure 2 displays the color-color diagram. The same criteria, as adopted in Paper I, to define C stars are traced. C stars are stars in the upper box with $(R-I)>0.94$. The 16 C stars identified in SagDIG are listed in Table 3, J2000.0 equatorial coordinates are given.

EDITOR: PLACE FIGURE 2 HERE.

EDITOR: PLACE TABLE **??** HERE.

## 3.2. Leo I

### *3.2.1. The color-magnitude diagram*

Leo I being much closer to us that SagDIG, rather short exposures were secured to reach more than one magnitude below the giant branch tip, sufficient to identify C stars. Its color-magnitude diagram is presented in Fig. 3 The number of foreground stars toward Leo I is much less than in the direction of SagDIG. nevertheless, a number of very red foreground stars are seen among the non carbon stars.

EDITOR: PLACE FIGURE 3 HERE.

EDITOR: PLACE FIGURE 4 HERE.

### *3.2.2. The color-color diagram*

The four filter technique allows to easily identify C stars in Leo I. There are 13 C stars in Leo I which satisfy our color index criteria, they are listed, in Table 4 along with their J2000.0 coordinates. As mentioned above, spectroscopic observations have confirmed at least 19 C stars in that galaxy. The comparison of the photometric properties of our list of C stars with those of the C stars already known, presented in the next section, shows that results are quite consistent. 7 C stars, listed in Table 4, are newly identified C stars, including two of them located $5'$ from its center, a distance well within its tidal radius (Irwin & Hatzidimitriou 1995) of $12.6'$.

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# 4. DISCUSSION

## 4.1. Previously known C stars in SagDIG and Leo I

Cook (1987) identified 26 C stars in SagDIG, using a photometric technique similar to ours. Twenty five of his 26 stars were found in our database. The missing one is near a bright foreground star and it may have been rejected because its profile fit did not converge. Only 8 C stars are however common to both lists. We present in Table 5 our magnitude and colors of Cook's C stars. One can see that many of them have $(R-I)_o < 0.90$ and are thus too blue to be called C stars, according to our $(R-I)$ criterion. Star #4 is redder that this limit but it is just outside our C star region because its (CN–TiO) is close to zero. On the other hand, four of our C stars are outside of Cook's CCD field. Three others, not seen by Cook, C11, C12, and C13 are among the faintest C stars in our list.

EDITOR: PLACE TABLE **??** HERE.

There are already known 19 spectroscopically confirmed C stars in Leo I (Azzopardi et al. 1985; 1986) plus one (#20 in Table 6) that is called by Aaronson & Mould (1985) a probable C star on the basis of its JHK colors and K luminosity. Because our definition of a C star is restrictive, being limited to stars with $(R-I)_o > 0.90$, it is not at all surprising that spectroscopy would have revealed the presence of warmer/bluer C stars not "seen" by our survey. This is indeed the case, as one can verify from Table 6, listing our photometric measures of the 20 C stars compiled by Azzopardi et al. (1986). Only six of them are red enough to satisfy our color criterion. The reader may ask: why limit the number of C stars by selecting such a red color? The main reason for this approach is that we adopt a criterion similar to the one used by Brewer et al. (1995) and by Nowotny et al. (2001) for their M31 surveys. By excluding bluer and fainter C stars, we facilitate their discovery in external galaxies and we collect a more homogeneous (in I magnitudes) sample that could

eventually be used as standard candles. In fact, one can easily see, by inspecting Figures 1 and 3, that the bluer C stars extend to much fainter magnitudes. These bluer stars can be detected in external galaxies but would require more telescope time.

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The numerous foreground Galactic stars toward SagDIG makes the determination of its C/M ratio highly unreliable. Indeed, we count only 13 C stars, redder than $(R-I)_o = 0.90$, while we count 699 M stars, in the whole $8.4' \times 8.4'$ field, redder than this limit.

Since SagDIG occupies only the central part of the field, counts in the northern and southern peripheries can be used, in principle, to evaluate the foreground contribution. These two zones, representing slightly more than half the field, contain 340 M stars. Thus we estimate that there are 665±5% foreground M stars in the field. The uncertainty attached to the number belonging to SagDIG is such that we cannot quote a meaningful C/M ratio.

For Leo I it is, however, easy to evaluate the C/M ratio. To do so, we observed a second field, located $14'$ south east of the center of Leo I. This field, identified as Leo I comp. in Table 1, contains 41 M stars and no C stars, as expected. The field centered on Leo I contains 56 M stars. Thus the C/M ratio of Leo I is $\approx 1$. This value is consistent with the C/M ratios of IC 1613 (0.64) and Pegasus (0.78) and reflects the lower metallicity of Leo I relative to the two more massive dwarfs.

## 5. CONCLUSION

Leo I and SagDIG are two low mass galaxies of rather different Hubble type but of identical absolute magnitude. Few C stars are expected in galaxies of such low luminosity.

More massive dwarfs, like NGC 6822, contain several hundred C stars. The small number of C stars, seen in these two systems, provides little else than the mean photometric properties of the C star population. In more massive dwarfs the spatial distribution of C stars can be used to map the outer parts of the disc or halo. Table 7 summarizes the photometric properties of the C star population in the two systems under investigation.

EDITOR: PLACE TABLE **??** HERE.

EDITOR: PLACE FIGURE 5 HERE.

Results, currently on hand, presented in Figure 5, brings further evidences that the mean absolute I magnitude of C stars, $< M_I >$, is nearly constant in galaxies of different metallicities and average $\sim -4.7$. The LMC point is based on the 590 LMC C stars with $(R-I)_o > 0.90$ observed by Costa & Frogel (1996). The NGC 6882 data point is from our upcoming publication (Letarte et al. in preparation). Error bars take into account the uncertainty of the mean magnitude and the quoted uncertainty of the distance determination. Most authors quote uncertainty of the true modulus to be $\sim \pm 0.1$ mag. Freedman (1988) quotes, however, $\pm 0.2$ for her IC 1613 distance estimate.

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Fig. 1.— Color-magnitude diagram of SagDIG. Note the well defined vertical ridge whose $R-I$ location is function of the reddening along the line of sight. C stars are shown as big dots. The bluer C stars, identified by Cook (1987) are represented by triangles.

Fig. 2.— Color-color diagram of SagDIG.

Fig. 3.— Color-magnitude diagram of Leo I, C stars are shown as big dots while the bluer spectroscopically confirmed C stars are shown as triangles.

Fig. 4.— Color-color diagram of Leo I.

Fig. 5.— The mean absolute magnitude, in the I band, of C stars, seen in different dwarf galaxies, varies little with the metallicity of the parent galaxy and may be a suitable distance indicator. Error bars reflect mostly the quoted uncertainties of the distance estimates.

Table 5. SagDIG C stars identified by Cook

| Cook | | | This paper | | | |
|---|---|---|---|---|---|---|
| No. | I | V–I | No. | I | R-I | CN–TiO |
| 1 | 19.50 | 1.73 | | 19.500 | 0.659 | -0.120 |
| 2 | 19.87 | 2.19 | | 19.836 | 1.058 | 0.157 |
| 3 | 19.95 | 1.52 | | — | — | — |
| 4 | 19.94 | 2.30 | | 19.887 | 0.987 | 0.127 |
| 5 | 20.02 | 2.38 | C01 | 19.859 | 1.017 | 0.257 |
| 6 | 20.14 | 2.67 | C02 | 19.830 | 1.169 | 0.278 |
| 7 | 20.21 | 2.47 | C07 | 20.262 | 1.021 | 0.226 |
| 8 | 20.23 | 3.16 | C05 | 20.150 | 1.042 | 0.557 |
| 9 | 20.36 | 2.10 | | 19.786 | 0.873 | 0.129 |
| 10 | 20.71 | 1.35 | | 20.539 | 0.776 | -0.124 |
| 11 | 21.11 | 2.04 | | 21.140 | 0.884 | -0.066 |
| 12 | 21.50 | 1.34 | | 21.437 | 0.696 | -0.021 |
| 13 | 21.50 | 1.51 | | 21.704 | 0.599 | -0.011 |
| 14 | 21.67 | 1.41 | | 21.882 | 0.558 | 0.022 |
| 15 | 20.46 | 2.70 | C06 | 20.227 | 1.089 | 0.238 |
| 16 | 20.39 | 2.14 | C08 | 20.375 | 1.165 | 0.285 |
| 17 | 20.68 | 2.91 | C15 | 20.701 | 1.469 | 0.224 |
| 18 | 21.42 | 1.66 | | 21.271 | 0.678 | -0.167 |
| 19 | 22.00 | 1.49 | | 21.685 | 0.793 | -0.094 |

Table 5—Continued

| Cook | | | This paper | | | |
|---|---|---|---|---|---|---|
| No. | I | V–I | No. | I | R-I | CN–TiO |
| 20 | 20.98 | 1.42 | | 21.051 | 0.589 | -0.070 |
| 21 | 21.77 | 1.55 | | 21.663 | 0.882 | 0.02: |
| 22 | 21.94 | 1.68 | | 22.0: | 1.5: | -0.5: |
| 23 | 21.42 | 1.44 | | 21.403 | 0.681 | 0.308 |
| 24 | 21.37 | 1.51 | | 21.471 | 0.852 | 0.12: |
| 25 | 21.58 | 1.51 | | 21.493 | 0.620 | -0.156 |
| 26 | 20.89 | 2.12 | C16 | 20.835 | 1.337 | 0.705 |

Table 6. Photometry of previously known C stars in Leo I

| No. | SpT | I | R–I | (CN–TiO) | C No. |
|---|---|---|---|---|---|
| 1 | C | 17.69 | 0.85 | 0.21 | |
| 2 | C | 16.92 | 1.01 | 0.24 | C01 |
| 3 | C | 17.60 | 1.01 | 0.33 | C09 |
| 4 | C | 17.38 | 0.91 | 0.27 | |
| 5 | C | 17.21 | 0.93 | 0.44 | C05 |
| 6 | C | 17.45 | 0.86 | 0.28 | |
| 7 | C | 17.62 | 1.10 | 0.30 | C10 |
| 8 | C | 17.30 | 0.95 | 0.26 | C06 |
| 9 | C | 18.77 | 0.99 | 0.11 | |
| 10 | C | 17.57 | 0.88 | 0.19 | |
| 11 | C | 17.79 | 0.93 | 0.63 | C12 |
| 12 | C: | 18.45 | 0.50 | 0.24 | |
| 13 | C: | 17.56 | 0.82 | 0.19 | |
| 14 | C | 17.01 | 0.79 | 0.17 | |
| 15 | C | 17.12 | 0.85 | 0.27 | |
| 16 | C | 17.47 | 0.86 | 0.32 | |
| 17[1] | | 18.59 | 0.54 | 0.27 | |
| 18 | C | 17.50 | 0.75 | 0.21 | |
| 19 | C | 17.76 | 0.76 | 0.10 | |
| 20 | ? | 17.52 | 0.86 | 0.26 | |

[1]Azzopardi et al. (1986) comment that this is not a C star.

Table 7. C/M ratio and Photometric Characteristics

| Galaxy | $N_C$. | C/M | $< I >$ | $< R - I >$ | $< I_o >$ | $< (R - I)_o >$ | $< M_I >$ |
|---|---|---|---|---|---|---|---|
| Leo I | 13 | 1.0 | 17.427 | 1.091 | 17.39 | 1.075 | –4.79 |
| SagDIG | 16 | | 20.359 | 1.138 | 20.24 | 1.10 | –5.06 |